CA2AL0G
50H23
May 30/50
Vol 4

ALBERTA LEGISLATURE LIBRARY
3 3398 00206 9366

ALBERTA PROVINCIAL LIBRARY

The Province of Alberta

PETROLEUM AND NATURAL GAS CONSERVATION BOARD

Application for Permission to Remove or cause to be removed Natural Gas from the Province of Alberta, under the Provisions of the Gas Resources Preservation Act by Northwest Natural Gas Company and Alberta Natural Gas Grid, Ltd.

I. N. McKinnon Esq., Chairman

D. P. Goodall Esq.

Dr. G. W. Govier

Session: MAY 30th, 1950.

Volume 4

Digitized by the Internet Archive
in 2019 with funding from
Legislative Assembly of Alberta - Alberta Legislature Library

INDEX

VOLUME 4

May 30, 1950.

WITNESSES

Page

STANLEY E. SLIPPER (Continued)

Direct Examination by Mr. Nolan........... 105
Cross-examination by Mr. Fenerty.......... 126
Cross-examination by Mr. McDonald......... 153
Cross-examination by Mr. S. Bruce Smith... 180
Cross-examination by Mr. MacDonald........ 184

: : : : :

VOLUME 4.

May 30th, 1950.

Q MR. NOLAN: Mr. Slipper, you are still under oath?

A Yes.

Q And you were discussing, or about to discuss a main head at the top of page 19 entitled "Gas in the Jurassic"?

A Yes.

Q That was the point at which we broke off yesterday afternoon?

A That is so.

Q Would you please continue from that point.

A GAS IN THE JURASSIC

The eastern boundary of the Jurassic strata is shown on Map No. 5. The Jurassic beds of the southern Plains area are usually called the Ellis formation (a more detailed division of the Plains Jurassic is shown in Figure 7). That is one of the columnar sections. On Figure 7, the second column from the left it shows a detailed columnar section of the Jurassic in that area where it is called the Ellis formation. That is around Pinhorn in south-eastern Alberta.

Q Is that the tiny little one?

A Yes.

Q You told us yesterday that was a very peculiar formation, and that is why it is set out here as you have done?

A Yes. The Jurassic in the foothills is usually called the Fernie formation. The Fernie consists largely of black shales with a few porous sands, consequently, there are

practically no important gas discoveries in the Fernie. Some gas occurs locally in the brown sand (Jurassic) in Turner Valley, but this gas is almost certainly vertical migration from the underlying Madison.

The Ellis formation is much more diversified than the Fernie. In the Medicine Hat rogion there are some prominent limestones as well as Basal sands, which like all the Basal sands on an unconformity, are characteristically irregular in their reservoir properties.

Five significant gas wells have encountered Ellis gas -

Name	Depth	Flow	Pressure
Range Well	2,655	25,000 Mcf.	-
McColl 9-17-1-8	3,200	6,300 Mcf. (DST)	-
McColl 6-8-1-8	3,211	6,200 Mcf. (DST)	1,600 psig.

In the latter two wells the closed-in gauge pressure was 1600 and 1550 respectively.

Name	Depth	Flow	Pressure
Dunmore Province 33-2-11-5	3,233	6,200	1,550 psig.
Dunmore Province 65-5-11-4	3,306	4,875	-

The Range Well and the McColl-Frontenac Wells are on structural anticlines associated with the volcanic activity which formed the Sweetgrass Buttes in nearby Montana. The structural condition at the Dunmore Province wells is not known. In the Drazan Well at Many Island Lake porous limestone as well as sands were encountered in the Ellis, but these were not tested,

In general, the Jurassic beds in the Medicine Hat region appear to be favorable for exploration

for gas. There is not sufficient data on which to base reserve estimates.

SUMMARY GAS RESOURCES OF GROUP 4

This completes the description of the gas possibilities of my division of Group 4. The reservoir rocks of the group are all sandstones. The source of the gas is probably in the enclosing marine shale except in the case of the Basal Lower Cretaceous the gas of which is suggested to be a seepage from the underlying Madison and Devonian rocks of Group 3. The gas in Group 4 is almost invariably sweet gas (H2S free) is usually a high methane gas though there are exceptions, and a few instances of a commercial gasoline content. The heat value ranges from 976 to about 1,000 BTU's depending on the amount of nitrogen present. Carbondioxide is a rare constituent. The opinion is expressed that there are large potential reserves in Group 4 strata indicated by many single well discoveries, but the required data to estimate these are not available at present. This last observation applies particularly to the potential gas possibilities of the Basal Lower Cretaceous sands.

NATURAL GAS RESOURCES OF GROUP 3.

TRIASSIC GAS

The eastern truncation of the Triassic system is shown on Map No. 6. Triassic strata do not extend much beyond the foothills of southern and central Alberta. In the Peace River region, it is encountered as far east as Spirit River. In southern Alberta, it is known

as Spray River formation and in the north it is classified as the Schooler Creek series. No gas has been encountered in the Spray River formation. I might put a remark in there that possibly the gas encountered at Imperial-Crossfield Well came from the Triassic beds. Probably because it does not occur outside highly disturbed foothills and mountains. The Schooler Creek beds consist largely of non-porous silts and limestones. However, in the mountain sections west of the Alaska highway some porous limestones have been observed in the Triassic. In the Guardian Well of the Pouce Coupe Field, gas has been reported in small volume. Gassy, low porosity Triassic cores have been obtained in some other wells in that region. The possible reserves in the Triassic are unknown, but probably are not important in Alberta.

CARBONIFEROUS GAS

The Carboniferous rocks are largely limestones and dolomites. I might also make another remark here. In using the Carboniferous I am using a rather old-fashioned term. It is usually now divided into two systems, one, the Pennsylvanian, and one the Mississippian. In Alberta practically all the rock are in the Mississippian system but I will continue to use the term Carboniferous.

There are several porous and permeable layers. The beds on outcrop have many bituminous bands indicating their petrolific character. In southern Alberta, the formation named the Madison has been borrowed from the American nomenclature, while in western Alberta, the names Rundle and Banff are used to designate a thick limestone

and a shaly sandy limestone respectively. The name Madison should include both of these, but at times Madison is used as a synonym for the Rundle limestone part of the Madison.

The Rundle is the most important gas zone of the Carboniferous. The Banff shale is unimportant. There are more known gas reserves in the Rundle than in any other formation in the Province. Figure 8 composite logs of Carboniferous and Devonian should be consulted.

Q Perhaps you might just give the Board a word of explanation on that.

A In southern Alberta the column on the left hand side of the chart has to be consulted. It shows the Rundle as being about 150 feet thick, and gas and oil has been obtained in it at wells in Princess and down along the U.S. border. It might also be remarked that when we are speaking of southern Alberta we should not forget that that also includes the Pincher Creek area where the gas and oil is obtained from the Rundle. In central and northern Alberta the Rundle contains gas and oil. In the Princess area and also at Barrhead it has not had many exploratory holes drilled into it on the plains because most of it exists westward of the present active drilling on the plains at a very much deeper depth. The outer foothills, and in that case I would also include Pincher Creek Field, the Turner Valley Field and the Jumping Pound Field, there are usually two zones. These are shown on cross-section of the third column as gas and oil zones. These zones are quite prominent on the outcrop and are usually saturated with heavy oil. This is particularly noticeable west of Olds in the first mountain overthrust.

East of the highly disturbed belt the formation becomes thinner and finally is truncated, as shown on Map.No. 7.

Q And that map, Figure 7, indicates?

A Shows the eastward levelling off of the carboniferous by a black line.

Q Yes, and shows within that area the Jumping Pound, Turner Valley and Pincher Creek Fields?

A That is right, and also the Princess Field to the east of there and the two wells at Barrhead northwest of Edmonton.

Q And something at Home-Brazeau?

A And Home-Brazeau. The gas in the Rundle has accumulated in anticlines and in up-dip edges of fault blocks in the foothills and it occurs in connection with laccolithic intrusions along the U.S.A. boundary in the southeast Plains. In the north at Barrhead and in the central plains at Princess Rundle gas, where found, is usually on or near the Mesozoic-Carboniferous unconformity. That is on the contact between my Groups 3 and Group 4.

TURNER VALLEY GAS FIELD

The Turner Valley gas and oil field has been described in many papers and publications. It is a foothills type of anticline and its geological history is shown in a sketch with this submission. That is the Figure 5. An attempt has been made here to show in a hypothetical way the region of the Turner Valley oil and gas concentration. The foothills anticline type of reservoir is shown in two stages of its history.

Q And that is in the diagram following page 21?

A That is right, and this diagram shows the first stage and the gas and oil accumulated in a moderate anticline.

Q And that is shown?

A In Stage 1, the diagram marked Stage 1. The second stage after extreme deformation, the anticline becomes an overthrust block with gas, oil and water on the west flank, with the east flank largely destroyed.

(Go to page 112)

Q Now, have you something to say about the characteristics of this type of reservoir?

A Reserves are affected by gas being released from solution with pressure decline on production.High base pressure may be caused by leakages and paraffin clogging bars along the down-dip wells. Other characteristics are similar to the fault type fields which are discussed later on.

The gas pays are two porous horizons in the Rundle limestone (see composite Log Figure 8). These two horizons, as I mentioned before, are shown there. The total reserves of Turner Valley have been estimated at about 1,700 MMMcf. with some 254 MMMcf. of this amount remaining as marketable. Part of these reserves are in the gas cap and part in solution. The ratio is about 1½ to 1.

Turner Valley appears to be almost completely developed. Its structural pattern has been delineated and the characteristics of the reservoir rock have received considerable study. The structure is an anticline with the east flank overthrust and destroyed as an oil and gas reservoir. In the northern portion of the field, the anticline degenerates into a series of fault blocks each of which contains gas and oil in the pays. In other words, the north end of Turner Valley proves that the fault blocks of the foothills can act as reservoirs. This is important because there are few anticlines of the Turner Valley type, but there are many overthrust blocks. Further proof of this is the discovery of Jumping Pound and Pincher Creek fields which are fault block types.

The pay formationsin the Rundle

are porous dolomites. These horizons have been subjected to great compression, tension and crushing stresses, which have profoundly altered the porosity of the zones.

Three different kinds of porosity are recognized -

1. The original porosity of the dolomite.
2. An induced porosity of tension fractures.
3. A network of induced porosity caused by crushing.

The induced porosities are irregularly distributed throughout the reservoir and cannot easily be determined in cores. On this account, reserve estimates are uncertain. If the intergranular pore space alone is measured, the reserve calculations will be too low.

THE JUMPING POUND GAS FIELD

The Jumping Pound Field is a fault block type of field. It has been described in several published papers. The field has three gas wells. These wells, together with a seismograph survey, are considered to give sufficient data with which to estimate the reserves. The gas water interface was established in two other wells at about 6,650 feet subsea.

The following date has been obtained from the Conservation Board.

Area - 5 ,700 acres.

Thickness - 147 feet.

Porosity - 9%.

Formation pressure - 3,990 p.s.i.a.

Temperature of reservoir - 160°F.

Connate Water - 20%.

Pore Space -

$$5{,}700 \times 147 \times \frac{9}{100} \times \frac{80}{100} = 60{,}329 \text{ acre ft.}$$

Deviation from gas laws at 3,390 p.s.i.a. = 0.87

600 p.s.i.a. = 0.935

Gas per acre foot -

$$43{,}560 \times \frac{4{,}003}{14.4} \times \frac{520}{620} \times \frac{1}{.87} = 11.67 \text{ MMcf. per acre foot}$$

Gas in reservoir at 400 p.s.i.a. $= 43{,}560 \times \frac{400}{14.4} \times \frac{520}{620} \times \frac{1}{.935}$

$= 1.1$ MMcf. per acre ft.

Reserves to 400 p.s.i.a. $= 60{,}329 \times (11.67 - 1.1) = 638$ MMMcf.

THE CHAIRMAN: You say that data was obtained from the Conservation Board? Were all the computations obtained?

A No, not the computations.

Q What data was obtained?

A The area, thickness, porosity, formation pressure, temperature of the reservoir, connate water, and the data in respect to compressibility.

Q You say the porosity information was obtained from the Board?

A Was obtained from the Board?

Q Yes?

A Yes.

It should be noted that porosities and connate water values are estimates. Since induced porosity is not taken into account in the calculations, it is probable that the actual reserves are higher than that given.

PINCHER CREEK GAS FIELD

The Pincher Creek gas field is a fault block type of field. It was discovered and is under development by the Canadian Gulf Oil Company. Like the Jumping Pound field,

the Pincher Creek reserve estimates are based on the results at three wells together with a seismograph survey. The field is assumed to be nine miles long and about three miles wide.

I have been furnished with the following information on the calculation of the reserves of the Pincher Creek Field.

This information came to me indirectly from the Gulf Oil Company.

Average thickness of pay zone - 394 feet

Porosity - 2.6%.

Area - 17,250 acres.

Formation pressure (at 8079' subsea) 4,930 p.s.i.a.

Connate Water - 20%.

Approximate gas water contact - 8,200' subsea.

Pore Space -

$$17,250 \times 394 \times \frac{2.6}{100} \times \frac{80}{100} = 141,367 \text{ acre feet.}$$

Total high pressure separator gas -

$$43,560 \times \frac{4,943}{14.4} \times \frac{520}{651} \times \frac{1}{0.957} \times .959 = 11.97 \text{ MMcf per acre foot.}$$

Total high pressure separator gas at 100 p.s.i.a. -

$$43,560 \times \frac{100}{14.4} \times \frac{520}{651} \times \frac{1}{.985} \times .917 = 0.22 \text{ MMcf. per acre foot.}$$

Total gas for field to 100 p.s.i.a. -

$$141,367 \times (11.97 - 0.22) = 1,661 \text{ MMMcf.}$$

Shrinkage factors for a liquid content are 0.959 for 4,943 p.s.i.
and 0.917 for 100 p.s.i.

From there on the computations are my own.

To compare this with the estimate for Jumping Pound which was given for 400 pound base pressure the following

calculation is given:

$$43{,}560 \times \frac{400}{14.4} \times \frac{520}{651} \times \frac{1}{.980} \times .920 = .907 \text{ MMcf.}$$

Total high pressure separator gas to 400 p.s.i.a. -

$$141{,}367 \times (11.93 - .91) = 1{,}558 \text{ MMMcf.}$$

Since induced porosity is not considered in these calculations the actual reserves are probably greater than the result given.

No other Rundle field has been developed, but important wildcat discoveries were made in the Brazeau Area.

BRAZEAU FIELD

Very extended favorable structures occur in the Foothills region northwest and southeast from Township 43, Range 17, West 5th Meridian. Two wells were drilled on one of the structures and commercial flows of gas were obtained in one of these, in the Blairmore. This gas is obviously a vertical migration from the underlying Rundle. The second well tested 7,500 Mcf. after acidizing in the Rundle at 9498 feet. The structure in this region requires considerable additional seismograph investigation. As stated previously, the prospects are very promising for the discovery of large reserves of gas in the Rundle in the relatively unexplored outer foothills structures for at least 400 miles northwest of the Bow River. I have suggested that there is reasonable expectation of at least 4,000 MMMcf. of gas reserves being discovered.

MADISON GAS SOUTH EAST PLAINS

Five gas wells obtained commercial flows in the Madison on small structures related to the Sweetgrass

Hills uplift.

These wells are:-

Well	Depth	Open Flow
Erickson Coulee	2531'	2,000 Mcf.
Mayland Southern	2840'	7,350 Mcf. some water
McColl-Frontenac 6-8-18	3282'	4,000 Mcf.
McColl-Frontenac 9-17-18	3287'	500 Mcf.
McColl-Frontenac (No number given)	3200'	3,300 Mcf.

The Madison reserves in this area are important only if considered in conjunction with the reserves in the other gas zones. According to Hume the Proven Reserves in the Madison are 7. MMMcf. (to 100 psia.)

MADISON GAS PRINCESS FIELD

Some Madison gas has been developed in the Princess Field. This gas occurs in the Madison immediately below the unconformity with Group 4. Some gas also occurs in the so called detrital zone lying on the unconformity. This Detrital gas is included in the Madison reserves.

Following are representative wells:-

	Depth	Vol.
Anglo-Canadian-Steveville 2	3262	2,000 Mcf. (decreased from 11,200)
Anglo-Canadian-Rainy Hills 1	3312-3332-3370	49,000 Mcf. decreased followed by water to 10,300 - and further decreased to 3750 Mcf. information incomplete further than that.
Empire Pacific No. 2	3297-3319	2,500 Mcf. (D.S.T.)

Princess C.P.R. 2	3262	11,200 Mcf. - produced field gas, now abandoned.
Princess C.P.R. 64-8-19-11	3298 - 3323	5,033 Mcf.
Standard Pacific 66-8-19-11	3286 - 3315	2,000 Mcf.
Standard Pacific 82-4-19-11	3277 - 3285	1,043 Mcf. with water spray.

The reservoir here is probably a small anticline combined with trap conditions along the unconformity. It appears impractical to estimate the Madison reserves in Princess field, though these supplies will probably be marketed in conjunction with gas from higher zones.

GAS IN CARBONIFEROUS AT BARRHEAD

Some gas has been found in the Barrhead district northwest of Edmonton. The gas apparently has accumulated on the Cretaceous-Carboniferous contact. The two gassers are:

	Depth	Flow
Stanolind Barrhead 1	2992 - 4036	5,000 Mcf.
O'Meara Barrhead 1	3973 - 3981	2,000 Mcf.

No further information is at hand to calculate reserves.

TABLE IV - SUMMARY OF RESERVES IN CARBONIFEROUS

	Proven & Probable	Potential
Turner Valley	254 MMMcf. remaining	
Jumping Pound	638 MMMcf. to 400 psia.	
Pincher Creek	1,558 MMMcf. to 400 psia.	
Remaining Foothills		Suggested Potential Reserves 4,000 MMMcf.

Foothills Total	2,450 MMMcf.	4,000 MMMcf.
Southeast Plains	7 MMMcf.	
Princess	(no estimate)	(no estimate)
Barrhead	(no estimate)	(no estimate)
Total Carboniferous		
	2,457 MMMcf.	4,000 MMMcf.

DEVONIAN GAS

This is shown on Map No. 8.

In the high dip anticlines of the inner Foothills, gas was found in the Upper Devonian. The flows were not large and considerable water occurred with the gas.

Moose Mountain Gas

	Depth	Flow
Moose Oils No. 1	Gas from 490-2815	500 Mcf. approx.
Elbow Falls No.2A	At some uncertain depth	3,660 Mcf.

Clearwater River Area Gas

Altoba Canyon	2377	1,000 Mcf.

A few other wells reported gas showings in the Devonian in the Clearwater regiom, particularly the Ram River wells. Both the Moose Mountain and Clearwater Wells were located on well defined anticlines where the conditions appeared to be very favourable for gas accumulation.

(Go to page 120)

In the Plains region some gas has been produced from the Devonian at Princess. The production appears to be associated with a small structural closure covering about two sections. My information on the Devonian pay is not complete.

The Devonian Gas Wells at Princess are:-

Princess C.P.R.	16-22-A	3934 - 3960	2,500 Mcf.
"	14-22-A	4844 - 4854	1,500 Mcf.
"	76-22-A	3853 - 3964	2,000 Mcf.
Princess C.P.R.	1	3960 - 3980	2,030 Mcf.
Princess C.P.R.	12-22-A	3925 - 3957	2,000 Mcf.
C.P.R. Princess	No. 2	3515 - 3555	5,000 Mcf.

In most of these wells there was some sulphur water showing with the gas flow.

The area above the gas water interface is difficult to determine and may be as much as 6,000 acres.

My estimate of the Reserves of Devonian Gas in the Princess Field is 48 MMMcf.

LEDUC DEVONIAN GAS

The Leduc Oil and Gas field has been described in detail in several recent publications. It is not necessary to discuss the geology here.

There are two gas zones. These are named the D2 zone and the D3 zone. The gas in the D2 zone is in solution in the oil while in the D3 zone there is a large gas cap as well as solution gas.

The Reserves in the D2 zone have been calculated by Dr. Pot of the Imperial Oil Company as 98 MMMcf.

The Reserves in the D3 zone in the gas cap, according to Dr. Pot, are 532 MMMcf. and in solution are: 242 MMMcf.

REDWATER OIL FIELD DEVONIAN GAS

There is no gas of importance in the D2 zone at Redwater.

Nor is there any D3 gas cap. All the gas reserves are in solution in the D3 oil.

If the oil reserves are 500,000,000 bbls. and the gas produced is 200 cubic feet per barrel, the reserves may be some 100 MMMcf. It seems doubtful that Redwater Devonian gas will be important as pipeline gas because of the low deliverability per well.

Q MR. NOLAN: Mr. Slipper, would you mind going back just for a moment to the Leduc Devonian Gas, that is in the middle of that page 26?

A Yes.

Q And you make this observation. "The Leduc oil and gas field has been described in detail in several recent publications." Have you those publications and what are they?

A No, I have not got them. They are in recent publications of the American Association of Petroleum Geologists.

Q Are they publications that are in the possession of the Board?

A They are in the possession of some of the members of the Board.

Q Privately owned?

A Yes, sir.

Q They are available anyway?

A They are available. And I can mention two publications - I cannot give you the date of them, one of them is quite recent and the other is a month or so old - which were published by Mr. Baugh, one of the engineers of the Board in Canadian Oils Magazine.

Q That is all, thank you. Now, you were going down to Golden Spike.

A GOLDEN SPIKE GAS

The area of Golden Spike is assumed to be 1 square

mile, pay zone 500 feet thick.

According to advice of Conservation Board Engineers the recoverable solution gas is about 340,000 S c.f. per acre foot and the gas reserve may be 340 x 500 x 640 = 109 MMMcf. (approx.)

I may say that nobody - I have no information as to the size of Golden Spike and I am only taking an assumed 1 square mile.

BON ACCORD - DEVONIAN GAS

There is some solution gas at Bon Accord D2 but this is probably unimportant as a reserve.

EXCELSIOR - DEVONIAN GAS

Solution gas at Excelsior is probably of no importance as a reserve.

TABLE V - GAS RESERVES IN DEVONIAN

(This is a summation.)

	Proven & Probable MMMcf.	Potential
Moose Mountain	-	No estimate
Clearwater	-	No estimate
Princess	48	-
Bon Accord	-	-
Excelsior	-	-
Leduc	872	-
Golden Spike		109
Redwater		100
	920	209

SUMMARY OF DEVONIAN GAS

The over-all prospects for gas reserves in the Devonian are difficult to determine. Before the discovery of

productive reefs in the Alberta Devonian, the system was not well known in respect to its prospects. Not many wells penetrated into it. Since the discovery of the Leduc Field, the exploration of the Devonian rocks has increased tremendously and our knowledge of the character of the productive zones is increasing daily. It is fairly certain that the Devonian except where disturbed by the Rocky Mountain overthrusts (which also deformed overlying formations to an equal degree) is folded in a manner only slightly more effective than the younger systems. Hence non-structural traps are as essential in the Devonian of the Plains region as they are in the other systems. However, there appear to be more basins of Devonian deposition within the Plains region. In the northeastern part of Alberta there is a middle Devonian basin with very thick salt beds centered around Elk Point. Westward and north there is a shale basin in the Upper Devonian followed by an anhydrite and salt basin southward in the Castor region. The coral reefs appear to have developed during the deposition of the shale basin. These reefs with superimposed compaction folds, so far, are the only type of gas trap found in the Devonian except for the small structural closure at Princess and the anticlines in the Foothills at Moose Mountain and Clearwater. The Gas prospects of the Devonian, therefore, depend upon the frequency of occurrence of reefs with "above water line" relief. At present, so little is known regarding this probability that no potential reserves beyond present discoveries can be predicted other than to express the opinion that very large reserves are to be expected.

SUMMARY AND CONCLUSIONS

TABLE VI - SUMMARY OF GAS RESERVES OF ALBERTA

(This is a recapitulation of the other Tables preceding it.)

	Proven & Probable MMMcf.	Potential MMMcf.
Milk River Sands		1,000
Medicine Hat Sand	107	636
Blackleaf	1221	255 plus
Lower Cretaceous	337	1038
Carboniferous	2457	4000
Devonian	920	209
	5042	7138

Total Proven, Probable and Potential - 12,180 MMMcf. from which I am deducting the error that was picked up yesterday of about 3 billion cubic feet, making it 12,177 billion cubic feet.

The estimates of Gas Reserves as compiled above are conservative. Where the term "no estimate" is used, I am confident that large additional reserves occur in the designated area, but because of incomplete information the volume of contained gas cannot be computed. I am also quite certain that each wave of active drilling exploration that occurs in the future will multiply these figures.

It should be stressed that 7.586 MMMcf. of the estimate is gas which is or will be tied into the production of oil and gasolene. The production of the gas cannot be restricted without restricting the oil production and eventually, as an adjunct to the production of oil, the excess of developed gas over the provincial market requirements will be of such magnitude that, of necessity, it will be either exported or wasted.

Q Then, Mr. Slipper, there are two Tables, numbered 7 and 8, immediately following the page which you have just read. That is a breakdown of the nature of the gas itself?

A That is an analysis of the gas at various points in the Province. In one or two wells in the text I mentioned the composition of the gas and these are just with that information.

Q For the information of the Board?

A Yes.

Q There is just one thing I wanted to ask you about. You say that you have compiled your estimates in what you describe as a conservative manner?

A Yes.

Q In a conservative manner?

A That is right.

Q I take it that is because of incomplete information?

A Largely so. I also have tried to be meticulous in not over-estimating it.

Q Even where information was available?

A Yes.

Q I notice there are a number of single well discoveries?

A That is right.

Q Not fields, but single wells?

A You mean wildcat wells that have obtained gas?

Q There are a number of them mentioned in this report?

A Yes.

Q Do you know how many there are?

A I do not know how many are mentioned in this report. I have a list of a number of them, an approximate list of the number of these wells over the Province.

Q How many are there?

A There are about 30 or 32.

Q You have made no estimate of reserves in respect of what you call these single well discoveries?

A I have not made any estimate in respect of single well discoveries.

Q Did you make any opinion as to whether or not there is gas there?

A I did, yes.

Q What is your opinion?

A There is a very large amount of gas but, as I have tried to point out, I cannot give a quantitative figure because I have not any more than the thickness of the sand and the fact there is gas there. I do not know how much gas there is there. Painful experience has taught me not to estimate gas reserves on one well.

THE CHAIRMAN: Does anyone wish to cross-examine Mr. Slipper?

MR. C. E. SMITH: I have something but I will bow to these people on my right.

MR. FENERTY: Well, I am prepared to go first, although I did think in view of the contest that was developing between my friend Mr. McDonald and Mr. Nolan that Mr. McDonald might like to go first.

MR. C. E. SMITH: I will go first if neither of them want to.

MR. FENERTY: Then I will go first if it meets with the Board's wishes.

CROSS-EXAMINATION BY MR. RENERTY:

Q Before coming to the notes I have prepared, I thought I might, while it was fresh in my mind, refer to it and that is the last paragraph in the, I was going to say "submission"

but I will say "report" you have just given. You refer on page 28, you say "The production of the gas cannot be restricted without restricting the oil production and eventually, as an adjunct to the production of oil - - - " It occurs to me that the same might be said and that the converse of that is true. That in all events, in areas where you have gas in solution in liquid that the production of gas will necessarily be restricted by the production of oil. Proration or restriction due to markets. That would follow, would it not?

A There will be restriction, yes, based on that but still there would be production of gas.

Q When we come to what gas is available and deliverability and so on, that is a material element to consider what production of oil will be allowed during those years?

A I imagine so.

Q I take it in the estimates you have seen, or your own, no consideration has been given to that question of production of oil in the future and markets and so on?

A No, not in my own, nor so far as I know in anybody else's.

Q All right. Now then, Mr. Slipper, at page 4 of your report you point out, in the second paragraph the different considerations which may apply in measuring gas accumulations where you have a structural trap as compared with a stratigraphic trap?

A That is right.

Q And then having that in mind I want to turn to your remarks on the Eagle Butte on page 9, and after you refer to what happened there in the last sentence you say, "If the well had been immediately closed in on discovery, some estimating methods used would have assumed an erroneous reserve of some

3 square miles." I take it that is a stratigraphic trap?

A That is stratigraphic.

Q I would like you to turn for a moment to Vermilion on page 17. You say in the second paragraph, under the heading "Vermilion and Lloydminster Fields" - -

A Yes.

Q "- - At one time it was believed that a large gas field occurred in this area. However, after unsatisfactory supply conditions for a few years, it is now realized that the reserves are very much less than earlier estimates indicated."

A Yes.

Q And then perhaps I might turn back to your observation at page 4, the paragraph I previously referred to when you speak of the possibility of delineating fields where you have structural traps and then illustrating the opposite condition in the Viking and Kinsella Field, which is a stratigraphic type of field. You say, "On the other hand, the Viking-Kinsella field, a stratigraphic type of field, had been producing for 20 years before the areal extent of the field could be determined."

A Yes.

(Go to page 129.)

Q And these two that I have already mentioned illustrate, shall I say, the impossibility of any reasonable estimate in relation to those stratigraphic traps except after a lengthy period of production?

A That is right.

Q And by the way, I guess all of us of the old timers are familiar with what I might call the series of optimistic estimates of gas in the Bow Island Field in the early days. Is that in the stratigraphic trap?

A That is in the stratigraphic trap, yes.

Q And then we do appear from what we have to date to have had such histories --

MR. D.P. McDONALD: I do not wish to intervene. I understand that the estimate of the Bow Island Field was 42 billion feet when it was originally discovered and no one has ever said there was more or less gas in it, that amount of gas was taken out so it must have been there to begin with.

MR. FENERTY: I am talking about the time you were in high school. I am talking about the troubles we had when we were trying to get gas in Calgary.

MR. D.P. McDONALD: I say that the estimate of Bow Island of 42 billion cubic feet was the estimate when the line was financed. That amount has been taken out. There is a difference between whether the gas became scarcer later on but the original estimate was 42 billion cubic feet and that is what it was.

THE WITNESS: I hardly think that is correct.

MR. FENERTY: The estimated gas we burned in our furnaces when cold weather came in the years away back. My

friend persists in talking about gas we are going to use for 150 years. The sooner we get down to what we are going to use in the immediate future the better we will understand the case.

MR. D.P. McDONALD: Let the witness tell us what it was, he was there at that time.

MR. FENERTY: The witness and myself seem to be in agreement.

MR. D.P. McDONALD: Was it underestimated or not?

MR. FENERTY: I think if the witness and I can agree my friend should not interrupt me.

Q We will leave out Bow Island, and I still remember when I could not get gas for my furnace, but we will leave it out. Now then, let us take one that my friend will have knowledge of, the Morinville Field. As I read the evidence that you have given, and the evidence given by Dr. Nauss in the other enquiry, there seems to be a very serious discrepancy in your estimates of gas in that field. I have Dr. Nauss at 740 and you with 240, which is not defendable, to use your own words.

A THE WITNESS: Yes, I used the figure of 240 as a possible reserve in the Viking sand in the Morinville area. I did not attempt to estimate the gas in the Lower Cretaceous there, which I believe is what Dr. Nauss did and he got the 740 billion.

Q But when you say it is not defendable, you mean it is probably generous?

A Yes, not by me.

Q Even that figure is generous, if not just?

A I consider it so for the Viking sand. I did not try to make an estimate of the Lower Cretaceous.

Q I am not quarrelling with that difference, I am just wanting to know is that another illustration of what can happen when you have a stratigraphic trap?

A No, that is purely a matter of two different estimates. It hasn't anything to do with the structural conditions.

Q There does seem to be room for wide divergence of opinion amongst the geologists?

A There certainly is in this case.

MR. C.E. SMITH: Having regard to the last few moments, lawyers cannot agree.

Q THE CHAIRMAN: I might ask the witness a question. Did you say you did not take Morinville into consideration at all in the Lower Cretaceous?

A Simply as one well.

Q Well, you have an estimate in here of the Lower Cretaceous gas in the north of 1 trillion feet?

A That is right. Morinville is included within that generalized estimate. I made an estimate of 1,000 billion feet in the area north of Edmonton of the Lower Cretaceous in which Morinville is included. I did not take a separate estimate of that.

Q MR. FENERTY: Now, turning to the Viking-Kinsella field, which has had some extensive development compared to other fields?

A Yes.

Q And I see that even there there is some difference of opinion between yourself and Dr. Nauss to the extent of 701 in one case and 842 in the other?

A Yes. I do not know what Dr. Nauss's figure is. You tell me it is 800.

Q Were you present at the other enquiry when information was extracted, shall I put it, as to Mr. Ralph Davies' estimates substantially less than either with reference to that field?

A Yes, I was not here.

Q Now, assuming that that is so?

A Yes.

Q That indicates that even in a field which has been more or less extensively developed over a period of years there is room for perhaps a great divergence of opinion amongst the geologists as to production?

A Quite so. All reserve estimates are approximations.

Q Now, I am going to suggest to you that those being facts, that when we are going to attempt to estimate what we have been calling proven reserves, and having in mind those differences of what occurred, that the only practical way of estimating them is to take the minimum in each case of competent geologists?

A That is right, I suggest so.

Q Take your minimum and other's minimums and we will arrive at very different figures than anything we have had presented to the Board, won't we? I don't need to follow that out, we can calculate that. You and I are in agreement that the only way to talk about proven reserves is the minimum?

A Well, it depends. Somebody might just deliberately put a minimum in. I don't see that you should accept any minimum you hear about.

Q I will amend that, assuming that all witnesses are bona fide?

A Yes.

Q The only proper way to estimate proven reserves would be the

minimums of all the opinions?

A The only way to get a minimum estimate would be to take a summation of the minimum figures, yes, I will go with that.

Q You would not want to pick out one geologist and say, "I'll take his," and another one's minimum and so on?

A Oh, no.

Q I think, without calculating, you will find if you take those minimums we are going to get much below anything any one individual has given us.

A I do not know. I never tried it. It is a new idea.

Q I think you will find it. All right, we will leave that. And the fact, as I take it, Mr. Slipper, that at least with reference to stratigraphic traps even when you take those minimums they may be either far too high or far too low, nobody knows until you have had production for a long period of years?

A I do not know as I go as far as you say, but you get increasing knowledge of a stratigraphic trap as you develop it.

Q The only reason I mention that is that that does appear to be the place of the greatest discrepancy.

A That is the most difficult type.

Q I quite agree. There are plenty of discrepancies with reference to other conditions and I am suggesting my reference to minimums applies to all formations. That is fair enough, isn't it?

A Yes, I suppose so.

Q Well, I will leave that with you.

A All right.

Q Now, I want to turn to a list of fields that you have mentioned

in what we call the index, and it is headed "Index of Fields for which reserves are estimated", and I take it that that is really what we are concerned with here in this enquiry?

A Yes.

Q And I do not want you to misunderstand me. When I ask you about these things I appreciate as well as anybody else there is a very complete and comprehensive report we have here on the geology of Alberta and possible supplies of gas, but I am concerned and my conception of this enquiry is concerned with the gas we will only be able to deliver at prices which are economical and within the next certain period of years, and I ask you to divorce your mind from consideration of gas in place, which is intensely interesting from a geological point of view. I want to try to get down to what I might call deliverable gas as distinguished from what, in view of reports we have, might be called newspaper gas. You see what I mean?

A Yes, I see what you mean but I would like to point out, Mr. Fenerty, that one of the engineers of the company who have employed me is going to come on the stand and discuss deliverabilities with you.

Q No, I quite understand. And I quite understand that this report is prepared in accordance with the instructions you received.

A That is right, and that is what I am being examined about.

Q I am fully aware of those implications, and I think we all are, but now that you understand, and having respect for your opinions, as I have, I do intend, unless stopped by the Board, to ask you many things as to what I call deliverable

gas. If you are not able to tell me you can tell me so but I do want to discuss them, because that is what I think we are interested in here, and I am going to confine my interest to it. I judge you will understand there is no sense of criticism of your report when I ask you to eliminate certain things?

A Yes, but may I point out that one of the things the Board has to determine is the overall reserves of the Province of Alberta.

Q Yes?

A And that is the particular question on which I was asked to answer.

Q I quite understand, and I have no criticism of what you have given, but I do hope to get something else.

A All right, let's try.

MR. C.E. SMITH: Now we have paraded to the post, let's go.

Q MR. FENERTY: Just as an illustration of that, what I am after, Mr. Slipper, let's take for instance page 5, where you are referring in the first paragraph, last sentence, to, "There is a reasonable expectation that within the remaining 400 miles of the gas seepage line, which is relatively unexplored, that at least another three or four trillion cubic feet of additional gas reserves will be discovered." Now, you are talking about that foothill belt going away up north?

A Yes, on northwards. As a matter of fact, I did not mention the area from Turner Valley south that has not been explored. We might add that to it and make this about 5 trillion.

Q Is that foothills area along the mountains?

A That is right.

Q It is fairly sure, is it not, that having in mind the possi-

bility of export, apparently with the potentials of the home market during the next 30 or 40 years, whatever it may be, those areas are not a factor and can not be a factor in determining whether or not we have gas for export at this time at a price which protects local consumption?

A I will suggest to you that about 75% of our future oil production will come from the foothills.

Q I am talking about what we are going to burn in the furnace in the next 20 years. We are in agreement as to this, that what we are going to burn in the furnaces in Portland and in Calgary in the next 20 or 30 years, we are not concerned with it. It is far from our lives, that would be a way of expressing it, in the next 20 or 30 years?

A No, I do not think so.

Q Well, I wonder if we are talking about the same thing.

A Maybe we are not. Let us do it over again.

Q Let us start over again. I am trying to find from you an expression of opinion as to gas reserves, recoverable reserves which will be available for the markets that the applicant seeks to obtain and for Alberta within, we will say, 20 or 30 years.

A Yes.

Q And I am trying to ask you, and perhaps in unskilled language, whether in your opinion these reserves of 3 or 4 trillion cubic feet that you have mentioned along the foothills north and south, will be available for those purposes within that period?

A Well, if somebody succeeds in getting permission to build a pipeline to export gas to the West Coast, I would like very

much to have the opportunity of going into the foothills and drilling some gas wells because I think there will be plenty of drilling done in the foothills if gas is exported.

Q All right. I was just using that as an illustration. Now, getting down to earth --

A Yes.

Q I am going to ask you and you will tell me whether you can do it, you will do it, as the case may be, if you will take these areas that have been referred to where you have estimated reserves, and I am not going to ask you to do it on the stand here with a piece of pencil and paper, I am going to ask you to prepare something for me, if you will, all leading up to what gas we have, we can use in the foreseeable future. I am going to ask you to take that table of the reserves.

A This index, table of contents?

Q It is headed "Index of Fields".

A Yes, I have it.

Q I am going to ask you first to eliminate those fields or those parts of those fields from your consideration where local conditions would indicate that they are, perhaps to use a word we have used before, "dedicated" to certain areas. As an instance of that I would suggest to you the Kinsella-Viking Field, and now the Leduc Field, as by contract or otherwise dedicated to the Edmonton area for supply. I would suggest to you for your consideration, you will tell me whether it is correct, that Medicine Hat field is being dedicated to that area. You may not agree.

A It is not; I disagree. I do not know whether I have the authority to dedicate anything to Medicine Hat. For Medicine

Hat it is quite a big field, it covers many sections of gas lines.

Q You make your estimate of what you think it would reasonably be dedicated to that area.

A There are four townships now dedicated to Medicine Hat, I think will keep it going for a good many years.

Q You make your estimate. I am only making suggestions as to what you should use.

A Medicine Hat is one of them.

Q Medicine Hat won't be left without gas whether there is export or not?

A No.

Q You tell me what is necessary for it and so on. And then you will, I suggest, consider various sources which may be small local supplies, if they are included in here for different local areas, which will necessarily be used for those areas. And then I want you to have in mind, and I do not know whether this can be done with the data you have, somebody is going to have to do it, I would like you to do it, if you can, exclude from your consideration those areas which in your opinion would be uneconomical, whether because of distances, whether because of cost because of distance, or various other considerations, having in mind two statements that we already have on record by Mr. Dixon, one being at page 7 of Exhibit 2, that "Alberta consumers will be protected in regard to price and supply." That is one statement. Having in mind the other statement at page 12 of Mr. Dixon's brief, in the middle of the page, that "Gas must be sold in large volumes for industrial use and this industrial gas must be priced to

compete with other industrial fuels." And my recollection is, and Mr. Nolan can correct me if I am wrong, in one of the other reports it is indicated that that would necessitate the sale of industrial gas at the Coast for 25 cents. I think it is 25 cents. And then that may necessitate your working back from 25 cents with immediate costs as shown in these various things, and find out what can be paid for gas at the well-head on that basis. It might be 1 or 2 cents if you come to figure it out. I would like you, if you can do all of those things, I would like you to tell me how many of those fields can be produced on that basis. I am going to try and be practical.

A All right, let us be practical. I am not competent to do that.

Q You are not?

A No.

Q Then you are not in a position to give us any assistance, am I fair enough?

A I will give you any assistance I can.

Q No assistance in telling us what gas is available as a commercial proposition to meet the conditions that are going to be encountered internally and for export. You can not help us at all? If so, I will leave it.

A You had better leave it.

Q Is that a fair statement?

A I say, you had better leave it.

Q Well, does that mean you just can not give us any assistance as to whether any gas is available for export commercially or not?

A No, not exactly, Mr. Fenerty. I am not here to take the whole

gas industry and discuss it through because I can not do it for one thing, and then you are not fair in asking me those questions.

Q Well, would it perhaps be fair to say it was a matter of opinion, you do not know?

A That is right.

Q Any large quantities available for export ?

A Say that again?

Q It is a matter of your own personal opinion and you do not know of any large quantities available for export, having in mind all the factors that we should consider. Is that fair?

A No. That is putting words in my mouth. I did not say anything like that.

Q I am just asking for your opinion because unfortunately -- I am going to call you Dr. Slipper. You are a doctor?

A No, I am not.

Q I thought you had a degree. Honestly, I thought you did.

A No, I learned my geology out in the field.

Q I am not criticizing you because you have not. I will tell you that much, after what I have heard. I am still going to ask you, you are subject to opinion, and it is a compliment to you, on matters you have not necessarily disclosed. What I am asking you is your own personal, honest, private opinion. Do you know whether in your own opinion you have gas available for export?

A You are asking me if I am of the opinion that there is enough gas to take care of Alberta and also leave sufficient over to supply export markets?

Q Proven area?

A Proven area?

Q Oh yes, that is what I am talking about.

A All right, proven areas. Yes, I think there is, in proven areas.

Q You say you think there is?

A Yes.

Q Now then, I am certainly now going to ask you how you arrive at it.

A By just saying Pincher Creek has got gas and Jumping Pound has got gas that is available for export.

Q Well now, you are going to be able then, if you have that opinion, to tell me in some way how you arrive at it?

A How I arrive at it? You asked me for just an opinion, I am giving it to you.

Q Can you tell me how you arrive at it?

A No, it is just an opinion.

Q You could not work it out and show me how much you would get in one year?

A Oh no, I am not doing that.

Q Would it be better to say it is a hope?

A All right, call it a hope, I don't mind.

Q I see. All right. Having come to this point, I want to go into some of those opinions with you at some length.

A I know that.

Q I still feel you can tell me a good deal about some of them, you do not think you can, because I have a lot more things I want you to eliminate, but you do not think you can start with a list of these areas and tell me?

A You ask me for it and I will try and give it to you.

Q You will try to give what you can?

A Yes.

Q All right, we will go on and see how much of it you can give to me.

THE CHAIRMAN: I think we might adjourn for a few minutes.

(The Hearing then took a short recess.)

(Go to page 143)

Q I am not sure just how far I got on the list of exclusions, Mr.Slipper. I would like you also to exclude from your consideration that gas which, in your own words, is not pipe line gas. You referred to some. Perhaps that gas is not included in that list?

A Yes.

Q And I will come back to that, what is meant by gas that is not pipe line gas, Mr. Slipper. But just while I am on that phrase, I would like to refer a moment to Page 24. You were dealing with the Southeast Plains there?

A Yes, sir.

Q You said that "the Madison reserves in this area are important only if considered in conjunction with the reserves in the other gas zones." Would that be gas that is not pipe line gas, and that sort of thing, or what do you mean by that phrase?

A I mean this, according to my estimate there is only seven billion cubic feet in the Madison. There are larger reserves of gas in the overlying formation in order to make this 7 billion.

Q Other gas zones in the same area?

A That is right.

Q I see. I see. Then if you can find out, or when you find out, what areas are to be coupled up to the proposed Grid system and export pipe line, will you also exclude from your consideration any areas that do not come within that, Mr. Slipper? They are not to be coupled up?

A You mean one column showing those that are and another column showing that aren't?

Q No, I have asked you to make certain exclusions from your

grand total?

A Yes.

Q And one of them now is gas in areas which are not the subject matter of pipe lines at this time, because we are not going to use it, it is just the same as up in Pouce Coupe, isn't it?

A That is right.

Q You see what I mean?

A Yes.

Q I hope Pouce Coupe was a proper illustration?

A It may not have been.

Q Well, say something up at the North Pole, you see what I mean, something that is not suitable for practical consideration?

A Something in the North West Territories?

Q Yes?

A All right.

Q Then, Mr. Slipper, you have given us some estimates of the recoverable gas in certain areas?

A Yes.

Q And would you, after you have arrived at your final total of what you have in place, you see, after all those exclusions, will you then apply your reasoning as to recoverable gas to that total and tell us how much you are going to be able to get out and burn economically, or can you do that?

A Yes. Most of these reserves that I have estimated here are on the basis of recoverables.

Q Most of those will be?

A Yes, most of them are.

Q Anyhow, you will make it plain that what you are talking

about will be recoverable gas?

A That is right.

Q Now, I do want to take a little time on some details that I will ask you whether they should be considered in making up those estimates?

A Just a minute. As I mentioned, the recoverable reserves I have given, they are in here.

Q All right, but what I am suggesting to you, and I think I am right, that if you exclude certain areas from consideration, because of the various factors I have mentioned, you necessarily will be excluding some recoverable reserves, won't you? You read this over, get a transcript of it, and I think it will read all right, and see what we are talking about?

A Yes.

Q I hope it will read all right?

A Yes, so do I.

Q Don't hurry yourself about it?

A No.

Q If it takes time you take it?

A All right.

Q Before I go into some of those details, I want to get to one further general conclusion, and perhaps you can tell me this, without making all of these calculations I have asked you to. On Page 28 you have given us the summary showing 5,042, what is that? That is billion, isn't it? MMMcf. is billion, isn't it?

A That is right.

Q And my understanding is that there would be, when you come to gas that will be used, as distinguished from recoverable, there will be certain deductions, which, perhaps we might

take a round figure, reduces that to some 4,000 billion that could be actually used?

A No.

Q Is this after making all deductions for hydrogen sulphide?

A No. That is just the gas from the ground, the raw gas.

Q And I am suggesting to you on the evidence we have in the past, I wonder if you agree with it, that when you have your deductions for mechanical operations, numerous other things, wild element and so on, that that might very well come down to some 4,000?

A I do not know what it would come down to, but it would be reduced.

Q All right. Now, then, assuming - these are going to be assumptions, you are not tied down to them at all - assuming a total usable as distinguished from recoverable on the basis of your 5,000 billion, a total of 4,000 billion usable?

A Just a moment now. You may say 3 billion or you may say 2 billion. I mean, I do not want to cut it down because I do not know.

Q I am asking you to assume 4,000?

A Yes, all right.

Q Yes. I am not saying it is correct?

A Yes.

Q But if it should turn out to be correct, just assume it is 4,000?

A Yes.

Q And again assuming, of which there is no evidence, assuming a market, or a possible market of 200 billion a year for 20 years, that brings you up to your 4,000, you see?

A Yes.

Q Is it your opinion that all of that 4,000 can be recovered in 20 years and delivered to the market?

A I don't see exactly what you mean. Do you mean that Alberta is going to stay without any more gas? I am sorry for asking the question. I am trying to clarify what you are trying to tell me, or trying to ask me. I do not understand that. You want to reduce this estimate to 4,000?

Q I want you to assume only?

A I am not assuming it, you are telling me.

Q Yes, but you will assume, won't you, for a calculation?

A All right, go ahead.

Q That is all. Assuming, as a matter of calculation....

A You have got 4,000 billion feet, and there is not going to be any more gas than that developed or discovered in Alberta for the next 20 years?

Q I am again going to ask you to divorce your mind from probable and hopeful gas?

A Get in a sort of vacuum?

Q Because I am talking within lines of policy which I have limited to proven areas, and I want you to tell me if we are limited to that?

A I certainly do not think so.

Oh, no, but it may be that that is where the export market will get its gas, maybe that is where the internal consumption will be, but at the moment I want you to deal with me on the basis of proven and probable?

A All right.

Q Which is further than I think we should go, of 5,000 billion?

A Yes.

Q By the way, as long as we are at it, how much of that is

what you call proven and how much probable?

A I did not separate it.

Q Well, you have got 5,000 billion proven and probable?

A Yes.

Q If you divide it into three columns instead of two, how much would you have proven?

A I couldn't do that.

Q You have some proven, have you?

A I don't know. It is probable and proven. I say what I mean by proven in the text.

Q Well, taking proven and probable, that is a pretty wide field, and you say it shouldn't matter as between proven and probable in computing what you are going to use?

A It depends how long you are going to use it.

Q Well, we will take it as proven and probable, and I am now going to ask you again to assume that as the result of mechanical operations, wild elements, and various other things that you get, the amount of 5,042 will be reduced when it gets into the pipe line, and may get down to 4,000, and again I am emphasizing that is not your figure?

A Yes.

Q Now, I am asking you if you are going to get your supply from a proven and probable area, and assuming a possible requirement of 200 billion feet a year for the market....

A 200 billion?

Q Over 20 years?

A Yes.

Q Which, according to my arithmetic calculation, amounts to 4,000 billion feet?

A Yes.

Q Whether or not you can get it out from the proven and probable areas in 20 years. In other words, whether you can get all that production out in 20 years? That is a simple question? If not, whether it will be 150 years, or some time in between. Can you give me something on that?

A You want to produce yearly? On this hypothetical case you want to produce yearly?

Q 200 billion?

A 200 billion.

Q Cubic feet?

A 200 billion cubic feet.

Q Yes?

A Yes.

Q That means 4,000 billion in 20 years?

A Yes, that means 4,000 billion in 20 years. In other words, you, in your hypothetical case, have reduced my proven and probable to 4,000.

Q Yes?

A You have taken a hypothetical case of 200 billion a year?

Q Yes.

A Divided it into the 4,000.

Q Yes?

A And it comes to a hypothetical figure of 20 years?

Q Yes?

A All right.

Q Can you get all of that gas out in 20 years, that is what I am driving at?

A I presume so.

Q And deliver it?

A I presume so, I do not know.

Q What is that?

A I do not know. I guess so.

Q Are you in a position to give me any opinion on that?

A No.

Q Well, aren't you back where you started? So far as you are concerned you are giving us a very helpful academic report for the purposes of this Inquiry?

A Yes.

Q As to the gas areas in this Province?

A That is right.

Q And you cannot tell ue whether it has any practical application to the questions we have before us or not, is that fair?

A I do not know whether it will be applied practically or not. I was asked to give, to obtain an over-all reserve figure, which I gave at 12 trillion cubic feet.

Q And you will notice I have not said anything in criticism of it, I am talking on the basis of the figures you have given us?

A That is right.

Q Can you help us in your experience over many years in the practical matters we have under consideration, can you tell us whether you can get this gas out, and whether it can be delivered, if you have within your branch of geology, have you that source?

A No. I am just here to give you this figure.

Q You see, and I will explain to you again why I am asking you this, we have been hearing Inquiries over some weeks?

A Yes.

Q And we have had figures, and they appeared in the headlines

of the newspapers, as so many trillions of everything, and when you get down to brass tacks we find it cannot be delivered. No question about that. We have had that. Now, I am trying to find out from somebody here whether we can deliver the stuff we need. Can you help us at all?

A Certainly it can be delivered. It can be delivered to some person.

Q All right, we have that. The next thing is, can it be delivered within 10, 20, 30, 40 or 150 years?

A Which, the 4,000 billion that you have stated?

Q Yes? That is a concrete illustration. That is the one at the moment. Can you deliver it within 20 years?

A Yes, I think so.

Q Pardon?

A I think so.

Q Would you mind preparing something to show how it is done?

A No, I do not mind preparing something to show you how I think it is to be done.

Q That is all you are asked to do, how you think it would be done?

A Yes.

Q You have to drill a certain number of wells, and you have certain production and so on?

A Yes.

Q Can you do that?

A No, I can't do it, but I just said I will try.

Q Oh, I see?

A I will try to do it for you, if that is what you want, but I have no information on that.

Q Now, I think - perhaps I won't ask you anything further

here. I did have a somewhat lengthy list of matters which I thought would have to be considered. For instance, I had ideas like this, and of course they are just amateurish ideas, that when you were considering whether or not gas was pipe line gas in a certain area, you would have to consider the life of the wells, the amount they were capable of producing during that life, the rate of production, and the pressure in the wells?

A Yes.

Q Whether it was a very low pressure which would necessitate very large gathering lines, and whether it was economical to instal those large gathering lines?

A Yes.

Q In view of the life of the wells?

A Yes.

Q The distance from main distribution lines and so on?

A Yes.

Q Do you think I would be wasting my time to go over those with you?

A I think so, sir. At least, I do not know anything about that.

Q There is no use of me doing that?

A No.

Q But within the matters that you feel you can give consideration to you will find out, won't you?

A Yes, I will do it on the particular points you asked me to.

Q I think it is not a matter, or it does not matter whether it is 100 billion or 1,500 billion. I just want to know what you think. Thank you.

......

MR. McDONALD: I have a few questions I would like to ask.

MR.FENERTY: I would like to reserve the right to perhaps ask some few questions later, if something develops. I think we have been doing that all along, because th person leading off is necessarily handicapped as to how things will develop.

THE CHAIRMAN: Yes.

......

CROSS-EXAMINATIONBY MR. McDONALD:

Q Mr.Slipper, if you would be good enough to assist me with regard to this Bow Island matter, which I was rash enough to interfere in a few minutes ago. As I understand the matter of the Bow Island reserve, the proposal was made that this field be developed about the year 1910?

A Yes.

Q The geologist who promoted the venture was Eugene Coste?

A That is right, he discovered the field.

Q He discovered the field?

A Yes.

Q In 1909?

A Yes.

Q I think it is common knowledge that Eugene Coste followed a theory with regard to the origin of natural gas which is known as the volcanic theory?

A Yes, and got $1,000,000.00 using it.

Q And that theory briefly was that there was some connection between the field and the bowels of the earth?

A That is right.

Q Which meant that the gas was there and never would diminish?

A That is right.

Q And that is the basis that the promotion was proceeded on?

A Yes.

MR. C. E. SMITH: You disagree with that, do you, Mr. McDonald?

Q MR. McDONALD: I am just going to ask Mr.Slipper this, if that is a generally accepted theory at the present time?

A No.

Q And to explain why I interfered with Mr. Fenerty's question, I just read you from Dr. Hume's report in 1948, and he is referring to the Bow Island Field, and he says:

> "By 1927, according to the Petroleum and Natural Gas Conservation Board, some 38 billion cubic feet of the original estimated content of 45 billion cubic feet has been withdrawn from the field,"

leaving roughly 7 billion cubic feet in place?

A Yes.

Q Now, I was referring to the original estimated content of 45 billion cubic feet, and that, I take it, was the original estimated content of that field according to the type of estimate that you have made, or is in common use today?

A I do not know just when a systematic estimation of the reserves at Bow Island commenced. Mr. Coste was the head of the Gas Company for quite a number of years, and I do not believe that any other geological assistance was obtained until after the Turner Valley gas was discovered. And I suppose about that time the reserves were estimated,

and I imagine that is where that figure of 42 billion came, that is about five or six years after Bow Island was developed, and, as a matter of fact, it was becoming increasingly evident that it would soon be exhausted at that time.

Q Yes. So that to use the bogey of Bow Island , where the original estimate was based on this volcanic theory, and relating it to present estimates of gas reserves, that is hardly a practical approach to the problem today?

A Well, it is an extreme example but still I imagine that some other geologists may have been in difficulties in trying to estimate the reserves in 1912.

Q Oh, yes. I think it is the first time it has been on record, Mr.Chairman, of what actually happened in that field. It has been referred to in all the Hearings that I have been in in the last ten years, and now it has been put on the record. That was my main interest.

MR.C. E. SMITH: You mean to make $1,000,000.00 on an obsolete theory, is that it?

MR.McDONALD: Yes.

A That is right. He also discovered three different fields on that theory, which is a better record than most geologists have.

Q MR. McDONALD: Now, Mr.Slipper, Mr. Fenerty did mention to you this reference to 4 trillion cubic feet in the Foothills to which you refer to on page 5?

A Yes.

Q You refer to surface gas springs and seepages, and then in the last sentence you express your opinion "That at least another three or four trillion cubic feet of additional gas reserves will be discovered." And I just thought, or

my interpretation of your evidence is this, you can tell me whether you feel it is reasonable or you agree with it, first you have your surface gas seepages and springs in the Foothills?

A Yes.

Q You refer to that in the text?

A Yes.

Q Then you have a folding condition which you also illustrate?

A Yes.

Q And in addition to that you have a known, three known Madison limestone gas reservoirs?

A That is right.

Q And what you state is that continued survey of similar areas will develop similar fields?

A That is right.

Q Now, am I fair in putting this to you too, that Turner Valley was discovered first by following a gas seepage?

A Yes.

Q And Jumping Pound comes into a different category, if I recollect rightly, the Shell Oil Company spent some two to three years in seismographic work before they ever drilled a well?

A That is true.

Q And it was from the information obained from the seismographic work that they located the field and drilled the well?

A That is right.

Q Now, similarly, if my recollection is right, there were some five or six years spent by the Gulf Oil Company in

locating the Pincher Creek field in seismographic work?

A Yes.

Q So that all you are saying here is that if similar work is taken north of Turner Valley or south of Turner Valley, within that belt, that without any shadow of a doubt in your opinion similar fields will be discovered?

A That is right.

Q You do not qualify that at all, that is a certainty in your mind?

A That is a certainty in my mind.

Q There is only one thing missing, and that is the expected revenue to warrant the expenditure?

A Yes, if similar fields are discovered there is not the return obtainable from sale of the product which would be discovered, and until that is evident the prospects of these extensive surveys are not a probability.

A You mean that there isn't any market for the gas?

Q Yes?

A Obviously nobody is going to drill in the Foothills for that type of field, is that what you mean?

Q Yes?

A Yes, that is quite true.

Q And that is what you mean in there?

A Yes.

Q And you feel if a market is established for the gas production that might possibly be discovered in this area, that the search may go on, and they will be discovered?

A I think so.

Q And it is for that reason that you took this 4 trillion and put it in your potential classification?

A That is right.

Q Can you just tell me this, Mr. Slipper, as you proceed northward on the Foothills belt, do you run from Alberta into Northeastern British Columbia, and into potential gas land?

A Oh, yes. Of course, my report here deals only with Alberta.

Q Yes.

A I haven't expressed my knowledge or opinion with respect to B.C. areas. It is the same Foothills, if that is what you are asking me.

Q Yes?

A The same Foothills, and the same conditions extend onward into British Columbia, yes, that is quite true.

Q The reason I mentioned it is I understand there is a gas seepage in Northeastern B.C.?

A Yes, the largest one I know of is there.

Q And at the present time the Phillips Petroleum Limited is drilling in the vicinity of one of these seepages?

A Yes, I understand that is correct.

Q In British Columbia?

A Yes.

Q And this illustrates the type of exploration that you have been referring to?

A That is right.

Q In other words, a large and responsible company is just following out the line of reasoning that you have presented in your report?

A That is right.

Q Now, Mr.Slipper, you refer to the Tertiary gas, and my understanding of that during theyears has been that it is what we call the Belly River gas?

A No. It is gas that is - I will try to take you on upwards.

There is the Belly River formation, and then we proceed upward into the Bearspaw, and then we proceed upward to the Edmonton, and above the Edmonton or maybe in the upper part of the Edmonton we get into what I call the Tertiary. There is the Pouce Coupe, Willow Creek, and Porcupine Hills bed. Those are the local formational mains, but it is up in those higher beds that the name Tertiary is applied to.

Q Now, as I understand your report, you do not suggest that that is the type of gas reserve, or that this type of gas reserve is a gas reserve that will be transported any distance?

A I consider that a purely local thing.

Q But it is of very great importance locally?

A Yes.

Q And the reason for that, I suppose, I suggest to you, or is it, th depth at which the gas can be recovered is very low?

A Around 500.

Q Around 500?

A Yes, around 500 or less.

Q Around 500 or less?

A Yes.

Q And I suggest to you that almost anybody can drill at very little expense and get a well at that depth?

A In those areas where this gas occurs, it is of great benefit to the farmers and ranchers and small communities.

Q And it is a clean gas, it doesn't contain any sulphur?

A A very fine type of gas.

Q It is comparatively low pressure?

A Yes.

Q That does not require expensive equipment?

A No.

Q I was very much impressed with your statement here that if this field was in Ontario it would have a very great economic influence?

A Yes. Of course, I should point out to you that in the Belly River formation, where I made that remark, the Milk River formation is really part of the Belly River?

Q Yes?

A And that is down at a lower level than the gas in the Tertiary.

(Go to page 161)

Q Yes?

A And is a little deeper but it is more extensive and extremely valuable to all Southern Alberta.

Q The reason I was interested in your reference to Ontario is, you might recollect that at the Dinning Commission an official of the Government of Ontario appeared and part of his evidence was to the effect that gas of this type in his Province was produced down to 50 pounds well head pressure and even less?

A Oh, yes.

Q It had to be vacuumed when required?

A Yes.

Q And also that gas had been produced since 1889?

A Yes.

Q So that the matter of the local production of gas,you have placed before this Board your estimate of roughly a trillion cubic feet which at no time will ever be susceptible of transportation without the Province and which will remain in the Province for the use of the people residing here?

A That is correct.

Q Now I wanted to deal, Mr. Slipper, with this matter of the Eagle Butte well?

A Oh, yes.

Q I think it is on page 9. Can you tell me was there more than one well drilled in this Eagle Butte area?

A Yes, there were two.

Q Two altogether, including this one we have referred to?

A Yes.

Q One other?

A Yes.

Q The other was abandoned?

A Yes.

Q And was not productive?

A No.

QQ The only thought I have, Mr. Slipper, with regard to these one-well discoveries, is this, that the well itself establishes that there is gas in that particular area?

A Yes, in that particular - -

Q Spot?

A Yes, spot.

Q And that gives you, the drilling of the well itself and the records kept of it, give you the depth of the sand?

A Yes.

Q So that you have one element on which to work out your capacity and that is depth?

A Yes.

Q And then the only thing left to be determined is breadth and length?

A That is right.

Q And where you only have one well that is a matter of judgment?

A Yes.

Q Now, if this was a structural condition then you would have geology upon which to base your judgment?

A That is right.

Q With a stratigraphic trap you have not the local condition, geological condition which will be of assistance to you?

A No. In the case of a large number of stratigraphic traps there are conditions where you might obtain additional information from geology that would help you in your judgment of the reserves you might expect and would give you something on which you could evaluate the potential reserves.

Q In some cases you had some assistance but which did not justify you in bringing out a judgment figure?

A Yes.

Q My knowledge of that is that Dr. Hume in estimating arrived at, using his judgment, he took an area of 3 square miles?

A Yes.

Q In the nature of a mile radius about a well?

A Yes.

Q That is a judgment?

A Yes.

Q In some cases would you go that far with him?

A I would go that far under certain conditions. If, for instance, the sand, the gas sand I was dealing with, was of the Viking type, which is a marine sand under a body of shale, our experience has taught us that such sands generally are fairly extensive. That they do not come and go. If I got a discovery of gas in such a sand, I might step out to the mile square. But if I had a discovery in the Lower Cretaceous Basal sand, I, because of my experience, would be very cautious about giving out any reserve value at all. It might have a tremendous reserve value and it might have very little or insignificant value.

Q You will recollect, I think I am repeating it to you correctly, from Dr. Hume's report to where he raised the same point?

A Yes.

Q In some of those areas where he used 3 square miles he might have been very optimistic?

A Yes.

Q And in others he would be very, very pessimistic?

A Yes.

Q But in general he thought he was justified in doing it. The reason I raise that is that Dr. Nauss' submission to the Board on the Westcoast application, Table A, Exhibit 3 as revised, he had 20 individual wells included in his over-all figure.

A You mean he had 20 in which he used the same square mile, or mile radius, is that it?

Q He used from 1000 acres to 2000 acres?

A I see.

Q There were a number he cut to 1000 acres. For instance, Golden Spike he cut to 1000 acres?

A I see.

Q The thought I had in mind is that came to about 176 million cubic feet divided over the 20 wells?

A Yes.

Q And would you care to, having in mind the individual wells, the 30 or more you referred to in your report, that in your line of estimating them or giving them a numeral value, would you arrive at somewhere in the neighbourhood of 200, 175 or 150 billion?

A No, I respect Dr. Nauss' reserve estimate but I would not give it myself. I would not do it.

Q But there might be cases where you could get one big individual well?

A Yes, I could go further than that. I could say that these 30 wells that I have referred to today, wildcat gas wells, anyone of them, might develop into a gas area which would be as big as any of the major gas fields we have now. But you have to do development, to get volume.

Q I think that is coincident with my own thought. Any one of

the 20 or 30 wells we have been discussing as individual items could develop into a 175 billion reserve field for that area?

A It might develop into a trillion reserve. There is plenty of land left.

Q There was just one other thought with regard to this Eagle Butte field. If you have an individual well we have the thicknes that is one step?

A Yes.

Q In order to get breadth and length you actually have to have four additional wells drilled. You have to have one drilled to the north, onedrilled to the east, one drilled to the south and one drilled to the west?

A No, 3 wells, that would establish the claim. Three points establish a claim.

Q Maybe you are right.

MR. C. E. SMITH: If you have a good enough one.

MR. McDONALD: The only thought I had in mind was you have to have three wells in addition to the discovery well?

A Yes.

Q And until you drill those wells it is a matter of judgment?

A It is a matter of judgment and experience.

Q And the only thought I had in mind in connection with the Eagle Butte well is, is it not entirely probable or possible that the Eagle Butte well might have been drilled on the down side of the dip, of the gas sand?

A Yes.

Q And therefore if the well had been drilled updip it might have well discovered any amount of gas?

A Yes, you can imagine things like that.

Q So the fact of discovering water in the oil of this kind does not of itself condemn the area?

A No.

Q I felt you did not go that far?

A No.

Q I thought Mr. Fenerty or some of the others might have thought you went that far and say that you condemned that area?

A Oh, no.

Q There is still a possibility of a field updip in these stratigraphic traps?

A That is right.

Q Another thought I have, Mr. Slipper, is this. The production from the stratigraphic trap should, as a matter of sound engineering, be on the basis of back pressure or restricted flow of gas in order to prevent water coning through the sand?

A Yes.

Q I notice you refer to the Anglo-Rainy Hills, is it, a well that produced 49 million cubic feet?

A Yes.

Q And would not you agree with me that is a substantial gas field when it produced 49 million cubic feet in a day, because that is definitely - -

A It is a substantial gas well and with that flow rate - I do not know of course how, I had no knowledge of the conditions under which the flowing of that well took place - but it is quite possible it was a coning condition. As a matter of fact with that high flow rate it seems to me from

what I read in it that it was left open. So that strongly suggests that there was a coning condition.

Q So that all of these matters raise a question of judgment?

A That is right.

Q In consideration of the engineering?

A Yes.

Q Now I am going to talk to you about the Vermilion field. I do not intend to go into it with you, but I may assure you that the parties who are interested in that field do not like what you say about - -

MR. C. E. SMITH: Surely this is beyond cross-examination, if you could call it cross-examination. I do not think Mr. Slipper is scared by your threats.

A You did not go far enough.

Q MR. McDONALD: On page 12, Mr. Slipper, the Viking gas sand in the Morinville area?

A Yes.

Q As I take it, you have referred to the 9 wells or the 8 wells, 8 productive wells, in that first paragraph?

A Yes.

Q The Cardiff Giant, the Imperial Excelsior No. 1, Imperial Bon Accord 2 wells, Imperial Legal 2 wells, Imperial Lily and Union Picardville?

A Yes.

Q You have estimated on the basis of Dr. Hume's evidence 240 billion?

A That is right.

Q Of potential reserves ?

A Yes.

Q That is in the Viking sand?

A

A That is in the Viking sand.

Q And in contrast to the point raised by Mr. Fenerty when talking of Table A, Exhibit 3, on the previous application and the same wells, Dr. Nauss gives an estimate of 142 billion cubic feet in the Viking sand?

A Yes.

Q I am just raising that. How did you arrive at the - -

MR. C. E. SMITH: What is that you are referring to, Dr. Nauss?

MR. D. P. McDONALD: Dr. Nauss, in Table A, Exhibit 3, has estimated for the same wells 142 billion cubic feet in the Viking sand. The acreage Dr. Nauss took into account there was 16,700 acres?

A Yes. It is more than I took into account.

Q It gives you about 24 sections?

MR. C. E. SMITH: I do not want to interrupt, but could Mr. McDonald give us the reference to the 142 billion?

MR. McDONALD: Yes, if you add the Cardiff Giant well, Dr. Nauss' estimate of 18 billion cubic feet and Imperial Excelsior No. 1, 18 billion cubic feet, and Imperial Bon Accord - -

MR. C. E. SMITH: All I mean is on what page do you find this in the submission?

MR. McDONALD: Table A of Exhibit 3.

MR. C. E. SMITH: Is not this Table A?

MR. McDONALD: That is right, yes.

Q Imperial Bon Accord 2 wells, 26 billion; Imperial Legal 2 wells, 58 million; and the Picardville well, 22 billion, making a total of 142 billion, and that is comprised of 16,700 acres or about 24 sections?

A Yes, I established some kind of a rough boundary in which I included those wells in about 120 sections and estimating 2 billion reserves per section. It is purely a guess on my part.

Q I was just wondering did you arrive at that 2 billion cubic feet per section by consideration with any other field?

A Yes, my experience has shown that the Viking sand, over a great deal of the country where it has gas in it, has run about 2 billion cubic feet per section.

Q Yes, and you have particular reference to the Viking Kinsella Field?

A Yes.

Q Now just comparing the Viking sand at Morinville and the Viking sand at Viking Kinsella, can you tell me, can you give me a statement of the pressures, the different pressures between the two or are they about the same?

A I do not know whether I have that information here or not.

Q As I understand, at Viking it was - -

A Viking, 754 pounds pressure. I mean original pressure.

Q And what about the other?

A I do not know the pressure. I have not got it with me anyway.

Q My information is it is from 765 to possibly 900?

A Has it raised that much?

Q Yes. There was one measured pressure which was used. Now connate water. Is there more connate water in the Viking Kinsella than there is in the Viking sand in the Morinville area, do you know?

A I imagine there might be. Morinville might have less connate water. I have no information on that.

Q Would you say the sand at Morinville was more permeable than at Viking?

A No.

Q Would your thickness of sand at Morinville be greater than the effective thickness at Viking?

A I would say it was about the same.

Q Have you actually investigated the electrologs or checked them?

A Yes, I did.

Q In Morinville?

A Yes.

Q The reason I mentioned it was that I have often heard it discussed in regard to the Viking Kinsella, did you not refer to three feet as effective?

A I referred to 8 feet and a probable effective gas zone in the middle 3 feet where the high velocity gas comes from.

Q And you give the Viking sand at Morinville 5 feet?

A No, about 8 feet or 9.

Q Now if you would look at page 13, we have another - no, page 10, Mr. Slipper. You deal there with, at the top of the page you deal with the Princess field?

A Yes.

Q And significant gas flows in the Basal Colorado. Now, as I interpret this Basal Colorado, it is similar to the Viking sand which is a Basal Colorado sand in the northern area?

A Well, I would not say that. I am not sure what your question means. I would not say the Basal Colorado sand at Princess is the same as the Viking sand. It is not the same sand. The Basal Colorado sand lies below the Foremost and Bow Island sands and the Viking sand is more or less equivalent

to -- did I get mixed up there. The Viking sand and the Bow Island sand are equivalent. The Basal Colorado sand lies below those two. It lies just about on top of the Blairmore.

Q It is a stratigraphic trap?

A Yes, I think so. We do not know an awful lot about it.

Q What I had in mind was this, that you have your 8 wells in that area in Princess, which, according to Dr. Hume, comprises 19,200 acres?

A Yes.

Q You accept Dr. Hume's calculation of the reserves of 93,200 billion cubic feet?

A Yes, as a minimum.

Q You feel it is higher?

A Yes.

Q And you give that a proven and probable classification?

A Did I put it that way?

Q That is my recollection. At page 13.

A Yes. I did not put a number on it. I said a large reserve suggested in the potential. I used Hume's figure for the 93,200 billion.

Q You used it as proven and probable?

A Yes.

Q We have a similar stratigraphic trap type and we have the same number of wells and we have less acreage. We have the same amount, if not -- at least I judge from your report we have the same information and you suggest 240 billion cubic feet in the Morinville area in the potential. I was wondering if you could not divide your 240 up between the 24 sections which have wells drilled on them and describe

them as proven and probable on the basis that Dr. Hume calculated in his Princess area which you have accepted and leave the remainder of your 240 billion cubic feet in your potential?

A Yes, I could do that.

Q That would be in line with your approach to the problem?

A Yes.

Q There is just one other point I want to discuss with you, Mr. Slipper, and that is on page 17 of your report, the Lower Cretaceous Gas, Edmonton and North?

A Yes.

Q Now you refer to "There is reason for an optimistic outlook in respect to reserves of Lower Cretaceous gas as far north as Township 108."?

A Yes.

Q As I calculated the area starting at Township 54 as being Edmonton ?

A Yes.

Q And going to 108 leaves you 54 townships north and south?

A Yes.

Q And then you have an area of approximately two meridians or 100 miles east and west?

A Yes.

Q Which gives you 100,000 square miles. Is that about the area you had in mind there?

A 100,000 square miles. Yes, something like that.

Q Then you predicted a saturation of 50 million cubic feet per section?

A Yes.

Q And based on 100,000 square miles would give you the 5 trillion cubic feet?

A Yes.

Q On the basis of the dry hole ratio as 5 to 1, I take it you have to divide, you have to take 20,000 square miles out of the 100,000, is that correct?

A Yes.

Q And still using your 50 million cubic feet per section you arrive at 1 trillion cubic feet?

A Yes, that is right.

Q And it appears to me then that the 50 million cubic feet per section over the 100,000 square miles could be contained in the net 20,000 square miles?

A That is right.

Q Yes?

A What you mean is this, they might strike anywhere a very tremendous big gas field that will give them the trillion cubic feet?

Q Yes?

A Yes, that is right.

Q Could we get down to a smaller area, Mr. Slipper? I would like to know if you could agree with me with regard to this, taking down to 54 at Edmonton?

A Yes.

Q And going north to Athabasca?

A Yes.

Q To Township 66?

A Yes.

Q And taking the same limits on the east, say near in the vicinity of the Angelus Ashmont well?

A About Range 15?

Q Yes? And taking the Western limits, say, the third range

west of the 5th?

A Range 5 going west to the - -

Q Say Range 3, West of the 5th?

A Yes, Range 3.

Q That would give you an area of about 70 by 90 miles?

A Yes.

Q 6,380 square miles?

A Yes.

Q I suggest to you most of the drilling where you arrived at the 5 to 1 ratio occurred in that particular area?

A That is right.

Q So that your application of your 5 to 1 ratio is fairly sound when it is restricted to that area?

A Yes. But I, of course, am assuming that area is characteristic of all the rest of the areas north. I have a pattern there. I have a certain number of wells drilled. I have a certain result. So I say there I have a pattern that is similar, that could be applied to similar lands to the North.

(Go to page 175)

Q Well, applying your pattern then to this particular 6480 acres would be a fair average block of 400,000 square miles?

A Yes.

Q And if you take one-fifth of that it comes to 596 square miles?

A Yes.

Q One-fifth of 6480?

A Yes.

Q Now, I was wondering if there is not some other approach to this matter of arriving at your value of gas per section in such an area. Could you not take some of the data from some of the wells that have been drilled in that area as a means of arriving at a figure rather than taking an arbitrary estimate? What I have in mind is, could we not use the acreage, the reserves per acre foot for representative wells in that area?

A Go through some kind of a set-up of probabilities? Maybe you could, I don't know.

Q As contrasted to an arbitrary figure of 50 million cubic feet?

A You could probably plot a probability curve that would give you something out of that.

Q What I have in mind, Mr. Slipper, is this, that in determining the reserves per acre foot you are not concerned with area except for that particular area, the information you get from drilling your particular well gives you the data upon which you determine your reserve per acre foot?

A Yes.

Q I was wondering if you would agree with this, what would be

a fair average porosity figure for that area?

A For the whole 100,000?

Q No, not for the 100,000 square miles, I mean for the 1296 square miles that I have in mind in the immediate vicinity north of Edmonton?

A I do not know.

Q Well, you would not care to hazard any?

A No.

Q 15%?

A No, I would not care to hazard a guess right now. I might be able to try to get you one, but it is something that is really -- to me it is a difficult thing.

Q Well, if you take the measured porosities of wells in the area, that would be a basis on which to arrive at a figure?

A Yes, but remember you would have to take the porosity of the whole Lower Cretaceous section.

Q That is true, yes.

A You could not confine it to just one bed, you would have to take the full average porosity over the whole section.

Q You won't hazard a figure of any kind?

A I would not like to, sir.

Q Have you any idea, would you hazard anything of a connate water field?

A Oh, it would be variable.

Q 15% to 20%?

A Over the whole section somewhere, it might be 80%, 90%, in other places it might be less. You are taking a bundle of beds of variable characters and types. You can not do that unless you go to a lot of trouble trying to figure them out.

Q And have you any idea what you would describe as average thickness of sand?

A The average amount of sand?

Q Yes?

A The ratio of sand to shale?

Q No, the thickness of the producing sand. Not the producing sand, the thickness of the sand?

A Well, I do not see how the question comes in. I did not specifically state,when I did that,any sand.

Q I know you did not. I was wanting to get out whether an approach of this kind can be made, which I think is interesting.

A It would be interesting but I could not offhand do that, no.

Q You can not?

A No.

Q What I am trying, Mr. Slipper, is to see if you could help me give any other approach to arriving at the valuation of the gas per section, and it occurred to me the content of the gas per acre foot related to the wells that have actually been drilled, and related to the wells which you have accepted in other parts of the Province, would be a measure?

A I think I see what you would like to do, and I think it would be something that would be quite well to do, that is, you are trying to get the ratio of sand to shale within the Lower Cretaceous section in this particular area, find out the gas per acre foot in the sand, the amount of connate water over all, from that obtain an average figure that applies to the whole Lower Cretaceous section, and then apply it over the

whole 100,000 acres that I did. I think it would be very valuable but I could not do anything with it now.

Q I was not interested so much in the 400,000 acres as in the previous area I outlined to you.

A Well, you would have to do the same thing with that.

Q The calculation that has been made by Dr. Hume and by others, the reservoir reserves per acre foot vary from 113 at Pelican in the far north?

A 113 what?

Q 113 Mcf.'s per acre foot.

A Yes, per acre foot.

Q To 560, 532 at Bailey-Long Island, for instance, and on the basis of taking the average of those two and using around 300 Mcf. per acre foot, you arrive at a calculation for the reserve in the immediate area to which I have mentioned, using your 5 to 1 ratio, something in the neighbourhood of between 4½ and 5 trillion cubic feet.

A 4½ for that particular area?

Q 4½ for that particular area, yes.

A Well, that is very interesting.

Q And it is an approach to the problem on the same basis that you used?

A For the whole area?

Q For the whole area, except in this case you used the actual data obtainable from the figures.

A Over my 100,000 square miles I should get about 10 or 12 trillion cubic feet?

Q That is correct, if you carried the same reasoning through.

MR. C.E. SMITH: Why stop at every 100,000? Let's

make it good and big.

Q MR. McDONALD: The 100,000 acres, Mr. Slipper --

THE CHAIRMAN: Square miles.

MR. C.E. SMITH: What is the difference?

Q MR. McDONALD: 100,000 square miles. There has been the geologic condition you laid down?

A THE WITNESS: That is right.

Q And there is a basis for that?

A Yes.

Q Just so that you understand the calculation I made, and for the record too, because I think it is of interest --

A Yes?

Q Using the figure of 300 Mcf. per acre foot, and using the thickness of the sand as 20 feet, times 640 acres, that gives you 3.85 billion cubic feet per section?

A 3.85 billion?

Q Cubic feet per section. Now, that is contrasted to your figure of 50 million cubic feet per section?

A Yes, quite a difference.

Q Then you multiply 3.85 billion cubic feet per section by 1296 square miles and get 5 trillion cubic feet. Now, just to contrast that to some of the other areas in the Province, Mr. Slipper, you have in the Princess Blackleaf formation 93.2 billion cubic feet for 19,200 acres, and you certify that is a minimum in your opinion, and you divide that out and you get 3.1 billion cubic feet per section?

A Yes.

Q So it would not be unreasonable, it is not outside the bounds of possibility, that the calculation I gave you for the

northern area is conservative?

A It is possible.

Q Well, we have it proved, known, certified by yourself as far as the Princess is concerned?

A Yes.

Q In the same type of formation?

A Yes.

CROSS-EXAMINATION BY MR. S.B. SMITH:

Q Mr. Slipper, how long have you practiced your profession in Alberta?

A Since 1913.

Q I suggest that it would be correct to say that you have an intimate knowledge of the geology of this Province?

A I have tried to gain that during the years, yes.

Q Well now, Mr. Slipper, with regard to the use of some of your terms, on page 13 you give certain definitions of proven and probably gas reserves that you define as, I take it, gas reserves, as estimated with a high degree of probability?

A Yes.

Q You are then, I take it, using proven and probable interchangeably throughout your brief and throughout your evidence?

A Yes. There is an inference there that some of them have a greater degree of probability than others.

Q It would be natural they would not be all uniform?

A No.

Q There would be differences, in some cases infinitisimal, in some cases greater?

A That is right.

Q Would it be fair to say that in your view the figures that you have given of 5,042 billion cubic feet of proven and probably gas in place in the structures set out on page 28, are, in your opinion and from the point of view of a geologist, proven reserves? I suggest that would be so?

A I am sorry, you get me in a position, Mr. Smith, which I do not like to take. To me the word "proven" in reference to gas wells assumes too much precision, and the word "possible" assumes too little.

Q I do not think we are in disagreement at all, Mr. Slipper?

A No.

Q Because it is quite obvious that no geologist or other human being can accurately measure the amount of gas in place in structures below the ground?

A That is right.

Q So from the geological point of view you used the data available from drilling experience ?

A Yes.

Q And using accepted methods you have to make certain computations?

A That is right.

Q And those computations lead you to certain conclusions which you as a geologist consider to be proven?

A Yes.

(Go to page 182)

Q That is as far as any human being or any geologist can go?

A Yes.

Q Well, then, I suggest to you that you are satisfied yourself that there are 5,042 billion cubic feet of gas in place in the structures which you describe on page 28? You are satisfied that that is so?

A I am satisfied.

Q Then when you get back to this other definition of potential, you define, on page 13, potential reserves as reserves less well defined than proven and probable?

A Yes.

Q And proven and probable we have been over, so that anything that has a less high degree of probability than that high degree of probability that you require for proven and probable you put within potential?

A That is correct.

Q Would it be correct to say that what you have included under potential still has a high degree of probability in your opinion?

A Yes.

Q In many cases very high?

A In many cases. It is a matter of judgment.

Q Anything not sufficiently high to prove it to you as a geologist has been put in the second column?

A That is right. I might point out some other geologist might not agree with me on that.

Q Yes, I can understand that, Mr.Slipper. I wonder if you would care to tell me whether you agree with the statement Mr. Dixon made before this Board yesterday, which appears at page 14 of his brief, that there are two things that

seem assured regarding Alberta. I am only interested in the first at the moment, and that is the immense discoveries of additional oil and gas. Would you agree with that statement?

A I haven't caught it.

Q There are two things that seem assured regarding Alberta, immense discoveries of oil and gas, and great increase of industrial development?

A I am bound to answer the first one yes.

Q I am only asking you about the first?

A Yes.

Q So that you agree with Mr.Dixon's statement?

A Yes.

Q There are just one or two other things that I would like to ask you about. Turning to Page 24 of your brief, at the end of the first paragraph, under the Brazeau Field, you make the statement, "I have suggested that there is reasonable expectation of at least 4,000 billion cubic feet of gas reserves being discovered." Now, just for my clarification, would you mind telling me whether that is the 4,000 billion cubic feet which is shown under the heading of potential gas opposite the word "Carboniferous" on Page 28?

A That is correct, yes.

Q Then would you tell me this, on Page 5, in the first paragraph, under the heading "Surface Gas Springs and Seepages", you say "There is a reasonable expectation that within the remaining 400 miles of the gas seepage line, which is relatively unexplored, that at least another three or four trillion cubic feet of additional gas reserves will be

discovered".

A That is the same figure.

Q That is the same figure that you are talking about?

A Yes.

Q That is what I wanted to ascertain. Thank you, Mr. Slipper.

....

CROSS-EXAMINATION BY MR. MACDONALD:

Q Mr. Slipper, I have one or two questions, which I am sure you will find very straightforward, as I am in the unenviable position of probably knowing less about this business and industry than anyone here present. In the first place, sir, on Page 7 of your report, I note there in the concluding sentence of your first paragraph, you say "I estimate the reserves of the Medicine Hat gas sand as about 743 billion cubic feet, classifying it as a potential gas reserve." Now, if you could turn a moment, sir, to Map 1. The Medicine Hat field, I take it, is the one which appears, well, shall I describe it as the largest of the blobs of black there in the southeast corner?

A That is right,yes.

Q That would describe it?

A Yes.

Q Well, now, sir, I refer you to the Viking-Kinsella Field, due north of that?

A Yes.

Q And I note that there the size of your, of what I choose to term the, blob is infinitely greater?

A Yes. Of course, if you will turn to Map 2....

Q Yes?

A No, Map 3. I am sorry, Map 3. The black blob is the developed Medicine Hat Field, and the area in which I give you this amount of gas is the dashed line surrounding it there. Do you see that?

Q Yes. Well, may I take it from that, sir, that the Medicine Hat Field cannot be said to be clearly defined, whereas the Viking-Kinsella Field has been defined, and the boundaries after 20 or more years are probably well known?

A That is pretty certain, yes.

Q And that is perhaps the reason that the size of those two is different, because I have in mind that in your estimates of reserves we have 743 billion in the Medicine Hat Field as against the more than 700 billion left in the Viking-Kinsella Field?

A Yes.

Q Now, sir, - incidentally, first, in passing, while we are talking about Medicine Hat, I do not note, in going back to the index of fields, I do not note in the column headed "Index of Fields" for which reserves are estimated, I do not notice any reference there to Medicine Hat. Am I missing it there?

A No, it should be in there.

Q In other words, you intended that Medicine Hat should be one of the estimated reserves?

A Yes.

MR.C. E. SMITH: Mr.Fenerty put it in for him too.

MR. MACDONALD: I wasn't trying to be clever, but I wanted to be certain that I quite understood where we were going.

Q Now, sir, I am afraid that I am going to have to, because

my primary interest naturally is the Edmonton area, I am going to ask you if you will accept one or two figures which I have sent up to Edmonton, and which I was supposed to have back in mimeographed form for this morning, and have not got, but if you will bear with me, sir, and I am handing to you a 1949 total of natural gas consumed within the City of Edmonton throughout in thousands of cubic feet, and the total comes to slightly under - these are the figures, incidentally, of the Northwest Utilities - the total comes for the year 1949 to slightly under 12 billion cubic feet?

A That is the figure 11,843,921 here?

Q That is correct. That is the figure at the end of 1949?

A Yes.

Q And because I just wish to use a round figure, I am using for the year 1950 a figure of 12 billion cubic feet as the annual consumption of the City of Edmonton?

A Yes.

Q In point of fact, the difference in consumption between 1948 and 1949 was a difference of over 1 billion, so that in moving up my figure from the total you have to a total of 12 billion even, I think I am being conservative. Now, I would like to ask you to make an assumption with me, which may, of course, be quite wrong, be a quite wrong assumption, but for the purposes of computing what Edmonton is going to require, I would ask you to assume that starting at the base year, 1951, Edmonton will be consuming not 12 billion but 16 billion. The only reason for giving you that changed figure is that in this year that we are in the Edmonton power plant expects to require 3,905,000 thousand cubic feet, or nearly 4 billion cubic feet, so that if you

will go with me, sir, with the total there, sir, at the end of 1951, which we will use as our base year, of 16 million thousand cubic feet, or 16 billion, and now I am going to make an assumption, one that is fairly straightforward, a fairly straightforward assumption, I am going to deal with the period '52, '53, '54, '55 and '56, a 5-year period, and ask you to assume with me that in each of those years we will have a 10% increase in the gross consumption in Edmonton.

A I am here just to give evidence on reserves.

Q Yes?

A Are you asking me about reserves?

Q Yes. I am coming to your 700,000, sir, and I am ariving at what I want in slow stages, but if you will bear with me I will arrive there in a minute. Using the 16 billion figure at the end of 1951, I am assuming, and I ask you to assume with me, with an annual gross increment of 10%, we can come to a figure of 25 billion as the annual requirement of Edmonton by the end of the year 1956. That is all I wanted to arrive at.

A All right.

Q 25 billion. Now, then, we are into very straightforward arithmetic. We have then there a four-year period?

A Yes.

Q A 100 billion requirement. And now, we can relate that 100 billion, which is a four-year requirement, starting at '56, we may relate that to your 700 billion reserve in that field?

A Yes.

Q And I just want to be certain that I understand that if

my figures bear any relation to fact, and that is open, of course, to question, but if my figures bear some relation to the facts, that particular Viking-Kinsella Field will only last for 28 years. It will only last, yes, it will last for only 28 years on that consumption of 100 billion for a four-year period.

A 28, that is seven four-year periods.

Q Yes?

A And you use 100 billion every four years?

Q Yes, 25 billion a year, commencing with the base year '56.

A Yes. On those computations of gas you are correct.

Q I mean, I am not holding any brief for them. I have to think they are right, but they could be in any way wrong.

A I am saying the 700 billion is correct, and if you use this 100 billion every four years, that makes it 700 billion.

Q Now, is it your opinion that there is any reasonable probability of the Viking-Kinsella Field turning out to have more than 700 billion?

A It may produce more gas than the 700 billion. The 700 billion reserve that I put there has got a high factor of safety applied, and there will probably be quite a lot of gas come out of the Viking-Kinsella Field after that 700 billion has been used.

Q And is it also possible that there will be less than 700 billion?

A I do not think so.

Q It is a fairly conservative figure?

A I consider it conservative.

Q Well, now, sir, I think my next question I have for you,

and I know you will tell me if it is the case, I presume that the reason that it has been made clear by your principals that they are not interested in the production of this field is not that it is in any sense a minor field but it is already spoken for?

A Yes. Your Viking Field is one of the finest fields in North America. It has got the finest type of gas, the best type of wells. It is easily produced. There isn't anything like it in the rest of Canada.

Q Well, sir, as a geologist, if Edmonton had to turn for its gas to the Leduc area, either to the Devonian or the Cretaceous of the Leduc area, would it be as easy to produce and deliver that particular gas?

A It is easy to produce, but the Viking gas is a dry gas. It is odourless. It does not produce any soot. It does not put any grease on the walls of the home. You will find that gas from the Leduc wells do that. It has a better grade of fuel than the Leduc field.

(Go to page 190)

Q Taking the findings of Dr.Pot, some of the gas in Leduc has, as I recall these figures you mentioned, has oil and some has not?

A It has much higher values, heavier hydrocarbon gases like ethane and propane. For instance, your Viking gas has merely methane.

Q Yes?

A The Leduc gas has got a high percentage of ethane and propane. These have more carbon in them and when they burn they produce more soot.

Q Let us relate those remarks to Dr. Pot's figures on page 26 of your own report?

A Yes.

Q You say "the reserves in the D2 zone have been calculated by Dr. Pot of the Imperial Oil Company as 98 billion cubic feet and the reserves in the D3 zone in the gas cap, according to Dr. Pot, are 532 billion cubic and in solution are 242 billion cubic feet.

Then you accept Dr. Pot's figures?

A Yes, I accept those unqualifiedly.

Q You have not had any occasion to make the estimates yourself?

A No.

Q This field having been developed by the Imperial Oil largely, this information comes through the Imperial Oil geologists and engineers, I judge?

A Yes.

Q What I wanted to ask you was when it refers to Leduc, the three zones, that is the D2 zone and the two D3 zones, is it recoverable for fuel consumption?

A Yes.

Q In other words, these three figures, the D2 98 million and the two D3 zones, are both usable?

A I think so. There might be a reduction in that volume.

Q That is what I thought. There might be less?

A There might be less, yes.

Q Do you know whether it is or is not a fact that that general Leduc area is presently being looked upon as the Edmonton supply after the Viking Kinsella Field is exhausted?

A I did not know that.

Q Well I do not know it. I just wondered. Now, I would like to just ask you a question about the top of page 18, if you please, Mr. Slipper. You are dealing in the second paragraph with the Lower Cretaceous and you say - I find it a little bit confusing, if you will pardon me saying so, this last sentence in that paragraph which says this: "The terrain is difficult and it is doubtful that gas development will be feasible in the near future over the greater part of the region." Now what I am wondering about is when you refer to difficulties you speak about the recoverability factor?

A No, I am speaking about accessability. Of getting in there to drill wells and space them right to gather the gas.

Q That means the same thing from an economic standpoint, does it not? Or could?

A No, in the case of deliverability you mean something else entirely.

Q That is one thing I wanted to clear up in my mind. Now you say over the greater part of the region. Were you referring to the whole region?

A No, the greater part of this northern region.

Q And what proportion of the whole comes out of that?

A I do not know but probably one-third of it.

Q About one-third of the whole region?

A Yes.

Q Now, sir, on page 24, regarding the Brazeau Field?

A Yes.

Q This is what appeared to me, if you will pardon me saying so, as being the only one of your excellent estimates which is not closely documented. In other words, the figure of 4000 billion in the Brazeau Field seemed to come as something of a surprise and I wanted to ask you if you are satisfied - I know you did not put it in proven and probable but put it in potential - and in answer to my friend Mr. Smith you said you regarded "potential" as in most cases having a high degree of probability - might I take it that with respect to the whole Brazeau field you are as satisfied in your own mind of the reserves as you are in other areas?

A That 4000 billion cubic feet is not designated as to the Brazeau field only. It extends over 400 miles of the Foothills.

Q Picking up at the north of the present Turner Valley field?

A Yes.

Q You referred to its area?

A That is the same reference.

Q The same range?

A Yes.

Q That clears it up then, the 4000 billion covers a long, long area?

A Yes.

Q Now I would like to refer you to a paragraph in the middle of page 17, sir. Speaking of the Vermilion and Lloydminster

fields you say: "At one time it was believed that a large gas field occurred in this area. However, after unsatisfactory supply conditions for a few years, it is now realized that the reserves are very much less than earlier estimates indicated." Were those the estimates made by company promoters or were those the estimates of geologists and engineers which turned out to be wrong?

A They were estimates of geologists.

Q Well we are on common ground because we all know, as somebody put it this morning, that man is pretty fallible when he gets below the surface of the ground, knowing what he is working down to?

A Yes.

MR. C. E. SMITH: As long as they don't cover you up.

Q MR. MACDONALD: Yes. I think I only have one more question and I am through. You must be very tired of all these queries. No, I think that is all.

A Thank you.

Q MR. BRUCE SMITH: I think I have one or two questions I have overlooked, if I could ask them now. When you were talking about the 4 trillions in the Brazeau Field on page 24, I think you did in your evidence refer to the unexplored Foothills, being at least 400 miles north and west of the Bow River. In evidence you also said you should have referred to the structures south and east of the Bow River, shouldn't you? You did say that?

A I do not know.

MR. C. E. SMITH: South of Turner Valley.

A South of Turner Valley, yes.

Q MR. BRUCE SMITH: You referred to that in your evidence but you did not in the brief?

A That is correct.

Q And if you take that into account would your 4 trillion on page 24 be increased?

A Yes. I did not submit it when I was answering the question but I think it could be put in. It would increase it.

Q It might well be a reasonable thing to increase your estimate of 4 trillion, then?

A It could be increased, yes.

Q Quite substantially, perhaps?

A Possibly.

MR. C. E. SMITH: I have something if there is nobody else ahead of me. But there is not much object in starting at this hour.

THE CHAIRMAN: We will adjourn until tomorrow morning.

(At this stage the Hearing was adjourned until 9.30 A.M. May 31st, 1950.)